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CQC
A NAVY PROGRAM FOR QUALITY CONSTRUCTION

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CHAPTER 1

INTRODUCTION

Much discussion has taken place regarding the subject of quality construction on Navy projects. There is agreement that the government should be getting everything that it is paying for, however, when budget limitations and time constraints are taken into consideration, the agreement tends to lose some of its fervor. This unfortunate circumstance exists as a result of the legislative and federal budget processes. Project requirements identified one year may take several years to reach construction as a result of the authorization and appropriation process. Meanwhile, the need for the new facility becomes more acute.

Once an Architect/Engineer (A/E) firm has been selected to perform design work, the race is on to complete the project within budget and without delays. Proper control must be exercised to limit the potential for waste, increased construction costs and substandard levels of quality in both design and construction. Failure to do so not only creates a discontented customer but also impinges on the reputation of the Navy Civil Engineer Corps (CEC).

Quality in construction is too important to be left to occur by chance. By taking a "do it right the first time" approach a cost savings benefit is derived through the reduction, if not elimination, of rework. Emphasis on high quality in both design and construction will lead to decreased contract administration cost while achieving schedule deadlines, a satisfied customer, and decreased life cycle costs for the new facility.

The requirement for quality in design is recognized as an inherent part of quality construction. This treatise, however, will focus primarily on quality in construction subsequent to contract award through the use of the Navy's Contractor Quality Control (CQC) program. The objective of the paper is to outline the current program, compare its use at different field activities, and to provide recommendations for its improvement. Usage of the masculine gender in this paper is for simplification only. It is recognized that women today are filling the positions described in this paper and make significant contributions to the overall construction effort.

CHAPTER 2

QUALITY CONTROL AS AN ENTITY

2.1 History

Quality control has been with us for a long time. Its evidence is present when one looks at the Pyramids in Egypt, the Great Wall of China, or the castles of Western Europe. But what exactly is quality control and how did its development as a system come about?

Quality control in its purest sense is the checking and verifying, by inspection or tests, conformance with established requirements and standards of excellence. In its earliest form it was practiced by the individual craftsman in the production of his goods. His pride and reputation were at stake as well as his livelihood. He set the level of excellence for his wares until his customers indicated, usually by a decrease in sales, that a higher level was desired. As society developed, guilds were established. These guilds banded a number of craftsmen of the same trade or skills together in order to regulate what was to be considered fair trade practices, i.e. wages and labor relations. They also set the level of quality of workmanship expected from members of the guild, which in turn the member enforced on himself and his employees. The guilds have since developed into today's labor unions with their diverse skills and

talents, each having its own control mechanism over the standard of work expected and produced by its members.

While pride and reputation as well as membership in a craft organization may have gone a long way to providing a quality product, the end result was not always what the customer desired or expected. Thus evolved quality control as a system with formal organization and responsibilities.

2.2 Quality Control as a System

Systems for quality control developed as man progressed into the industrial age. Its first appearance was in the form of inspection of a product after it was made. Since this only identified unacceptable products after completion, attention turned towards the processes designed to produce the product in an effort to reduce rejects.

Use of statistical analysis in quality control was developed by Bell Laboratories in 1924. Adoption of these techniques was slow until the advent of World War II when industry, spurred by wartime needs, began to use them. By the end of the war, the techniques of Statistical Quality Control (SQC), as it was known, were well on the way to becoming an established means of industrial control.

In the construction industry, the functions of inspection and quality control have typically been focused on the building phase of a project. While this is where they are most visible, the process must actually start earlier during the design process. Early discussions are needed between designer and owner to ascertain the level of inspection and quality needed. In addition, the designer must exercise quality control on his own work in order to reduce potential design related problems during construction.

The achievable level of quality in the construction phase is reduced by design errors, unqualified construction personnel and inspectors, and disregard for inspection and quality control by different members of the building team. Unofficial figures indicate that 15%-20% of all new construction budgets are wasted due to poor quality. At least 15% of all field labor goes to correct mistakes. A British study stated that about 60% of quality problems were caused by design [Pandazides, p. 12].

These problems caused many in the construction industry to reevaluate the inspection and quality control functions. As a result, better methods of contract administration were sought to ensure that the owner received the most for his construction dollar, while at the same time the most equitable conditions

for all members of the building team were created [Dean, Carr, Meyer, p. 536].

Formalized guidelines were established to delineate the responsibilities of members of the building team for inspection, testing, and documentation of the work being performed. This allowed for direct control of the quality of construction materials and methods.

2.3 The Navy Contractor Quality Control (CQC) Program

Quality control was born during the reorganization of the Department of Defense (DOD) in the early 1960's under then Secretary of Defense Robert McNamara. In 1961, a new clause was incorporated into the Armed Services Procurement Regulation (ASPR) that stated that:

the contractor shall (i) maintain an adequate inspection system and perform such inspections as will assure that the work performed under the contract conforms to contract requirements, and shall (ii) maintain and make available to the government adequate records of such inspections.

It was initially directed at manufacturing in an attempt to reduce the DOD budget. In its application to construction, the intent was to bring the construction industry more in line with other traditional manufacturing applications where most industry producers do their own quality control. While the intent was clear, in practice it had minimal effect. Many people felt that contractors were relying

too heavily on government inspectors for control of quality and workmanship. This situation led to problems of "implied consent" whereby construction defects which were unnoticed by the inspector were assumed to be acceptable. In other cases, contract delays occurred as contractors halted operations to wait for government inspection [Willenbrock and Shephard].

In March 1970, the Navy culminated a reevaluation of its position on the construction industry and implemented an ambitious program which it called Contractor Quality Control. It placed more emphasis on making the contractor responsible for the quality of his work. The program was defined as a management system maintained by the contractor that assures compliance with the contract plans and specifications. Some of the benefits expected of the program were better use of personnel, more control by the contractor of his own operations, and fewer claims. Economic savings due to reduced amount of delays and to increased probability of finding and correcting mistakes quickly were expected. In effect, less duplication of effort and more teamwork were expected to achieve a better job for less money [Dean, Carr, Meyer, p. 536].

CQC has evolved through the various successes and failures experienced in its application. The most recent evolution occurred through the inclusion of more stringent personnel qualification requirements for people in the contractor's quality control organization. This development grew out of the success of such requirements in the program known as CQC+ at OICC Trident, the Navy's new submarine base at King's Bay, Georgia. Efforts such as this have provided stricter guidelines for the contractor to adhere to while providing him the necessary expertise to perform the task of quality control.

The impetus today is on an increased level of quality inspection by the contractor's organization to ensure the taxpayers are getting what they pay for, as well as the added government incentive of managing work force to budgeted payroll. Throughout its development CQC has strived to be a cooperative program between the Navy and the contractor.

CHAPTER 3

THE CONTRACTOR QUALITY CONTROL PROGRAM

3.1 Application

The Navy's CQC program has developed into a flexible system that can accommodate differences in project type and complexity. Current guidance from Naval Facilities Engineering Command (NAVFACENGCOM or NAVFAC) is to exercise CQC on projects of \$2,000,000 and up or on projects of technical complexity of lesser value. The actual decision as to its application has been delegated to the appropriate Engineering Field Division (EFD). NAVFAC policy charges the designer and contract administrator to carefully tailor CQC provisions to the circumstances of each individual construction contract.

This chapter will describe the contractor's requirements as delineated in the NAVFAC Guide Specification on CQC. The government's role in administering CQC will be reviewed, provided by guidance in LANTNAVFAC Instruction 4355.1C, enclosure (1) CQC Guide for ROICCs, and the Contractor Quality Control Seminar conducted by Western Division NAVFAC.

3.2 Contractor Requirements

Prior to bidding on a contract it is important that the contractor understand what will be required of him. Specific guidance is provided to the contractor

by NAVFAC Specification Section 01400, Contractor Quality Control (CQC) System, and in the individual technical specification sections. The level of detail provided by the specifications is important in order for the contractor to understand and bid the work properly.

Subsequent to the award of the contract, the contractor is required to submit a CQC plan within a specified period of time, usually 30 days, for approval by the Contracting Officer or his designated representative. The plan must be comprehensive and should detail procedures, instructions, and reports to be used in the performance of quality control on the project. The contractor should strive to accomplish this task as quickly as possible as he is not allowed to start work until his CQC plan is approved. Prior to approval of the CQC plan, the government can require the contractor to correct, change, or modify the plan as necessary to rectify shortcomings in the CQC plan. During construction, if the contractor provides substandard performance, more stringent requirements can be added to insure quality.

Before commencement of the work, the contractor is required to attend a preconstruction conference. In this meeting the government representatives will discuss all CQC requirements as well as lay down the

ground rules for the project. In addition, an initial CQC meeting is held in which every detail of the contractual requirements relative to CQC are reviewed. In this meeting the philosophy of the program is also discussed.

After the project has commenced, the contractor is obligated to hold a weekly, or bi-weekly, CQC meeting which is conducted by the contractor's quality control representative. Other attendees at the meeting include the Navy inspector, contract administrator, contractor's superintendent, customer representative, and any supplemental CQC staff. This provides a forum in which all matters pertaining to quality can be discussed; be it deficiencies, upcoming work, tests, or inspections.

3.2.1 Quality Control Organization

The key individual in the contractor's CQC plan is the CQC Representative. He is required to be on the site at all times during construction. He is appointed by a letter signed by a responsible officer of the firm, which shall outline the duties, responsibilities, and authority of the CQC Representative. He may not serve as, nor be subordinate to, the project superintendent or project manager. Properly appointed, the CQC Representative is able to enforce compliance with the plans and

specifications, thus maintaining his sole responsibility of monitoring the quality of construction.

The quality control organization can be expanded as necessary to accommodate contract requirements of a highly technical or complex nature. In these instances individuals whose areas of expertise encompass a particular item of concern, such as mechanical or electrical trades, are to be employed and appointed for those specific areas as CQC representatives. Requirements for these specialized individuals will be outlined in the contract documents.

The required technical qualifications of the CQC Representative, his alternate, and any supplemental personnel are detailed in the contract. The "rule of thumb" is that the CQC Representative and his alternate be graduate engineers or architects with three years experience on construction similar to the type being performed. The CQC Representative may be required to be a registered engineer (P.E) or architect (R.A.) if the circumstances warrant it. The supplemental personnel requirements may be adjusted to satisfy the requirements of specialized construction.

The contractor must provide sufficient quality control personnel to discharge all contract requirements. He must provide a quality control

organizational chart (Fig. 1), showing the relationship of the quality control organization to other elements of the firm and its subcontractors. The QOC plan also requires identification of all personnel in the quality control organization and their areas of responsibility and authority. A listing of outside organizations such as testing laboratories and consulting engineers that will be employed and a description of the services they will provide must also be submitted. Proper preparation of the organization will insure the contractor has identified his needs in advance of construction, is planning to meet those needs, and has not overlooked or underestimated the requirements.

3.2.2 Submittals

Submittals are required by the contract in order to regulate the timely flow of materials incorporated into the project and to show compliance with particular drawing or specification requirements. Submittals may take many forms such as:

- shop drawings
- catalog cuts
- samples
- certified test data
- letters of certification

Sample CQC Organizational Chart

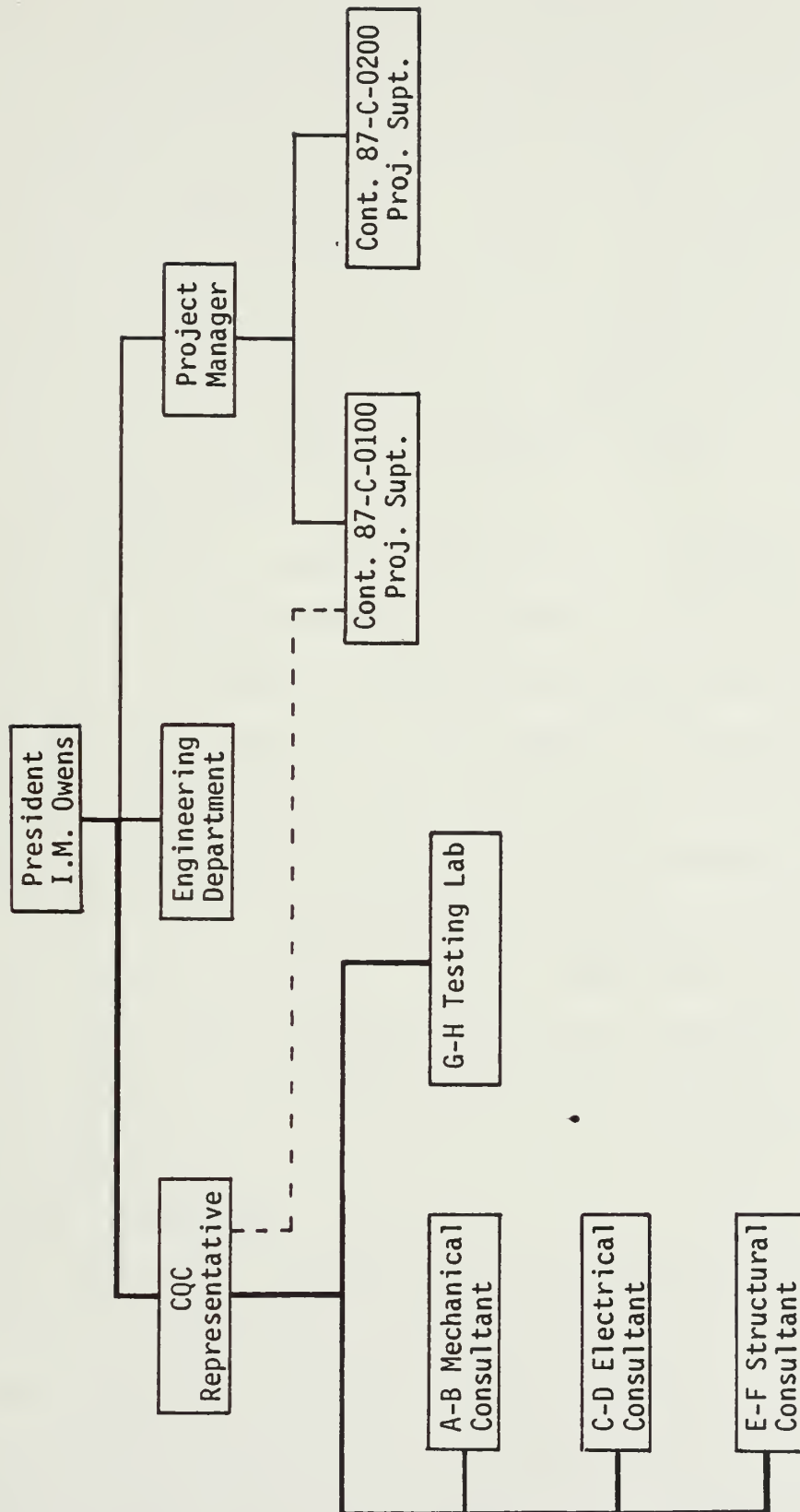


Fig. 1 - Sample CQC Organizational Chart

In each case the contractor is required to certify that all material or equipment that is identified by the submittal is in compliance with the contract drawings and specifications. Under the provisions of CQC, the responsibility for review and approval of submittals belongs to the CQC Representative. On occasion the government may retain approval rights and require that submittals be forwarded for approval vice merely record purposes.

Identification and status of submittals is important in the construction process. The contractor is required to keep an up-to-date CQC submittal status log on the job site at all times. Inclusion of submittal requirements regarding the construction schedule, and proper monitoring by CQC personnel, will help insure timely submission and eliminate potential submittal caused delays. It is important that the contractor be made aware that handling of submittals is as important as the actual construction if everything is to flow smoothly.

3.2.3 Inspection

The contractor, through the CQC Representative and his staff for quality control, is required to inspect all work mandated by the contract. During the CQC plan submittal process the contractor provides an inspection schedule, keyed to the construction schedule and

following the order of the specification sections. The schedule will indicate what inspections and tests will be performed and the time schedule for each inspection and test. The CQC plan also includes procedures for the three primary inspection phases: preparatory, initial, and follow-up.

Preparatory inspection is performed before beginning work and includes; review of the contract requirements, review of shop drawings and other submittal data, a check to ensure required control testing will be provided, a physical examination to assure that all materials and equipment conform to approved shop drawings and submittal data, and a check to make sure all required preliminary work has been completed.

Initial inspection is performed as soon as a representative segment of the particular item of work has been accomplished. It includes the performance of scheduled tests, examination of the quality of workmanship, a review for omissions or dimensional errors, and approval or rejection of the initial segment of the work.

Follow-up inspections are performed daily or more frequently as necessary, and include continued testing and examinations to assure continued compliance with the contract requirements.

In addition to the three phase inspection requirements, certain special inspection requirements may be contained in the specification sections. Each special inspection is performed and a record of the results is submitted on an "as occurred" basis.

The contractor is not only required to perform inspection on the job site. On occasion he may be required to perform quality control inspections at a factory for items that are fabricated off site. Factory inspections are specifically noted in the appropriate specification sections.

When work has been put in place and does not comply with the contract requirements, it is the CQC Representative's responsibility to reject the work and require its correction. In this endeavor he maintains a Non-Compliance Check-Off list of work that does not comply with the contract, stating specifically what is not complying, the date the faulty work was originally discovered, and the date the work was corrected. Work that is corrected the same day as it is discovered need not be recorded. The CQC Representative shall not allow the contractor to add or build on non-conforming work unless correction can be made without disturbing the continuing work.

Upon completion of his efforts, the contractor is required to submit a certification signed by the CQC Representative to the Contracting Officer, stating that all work has been inspected and that all work is complete and in compliance with the contract requirements. He will also schedule a final inspection of the project with the government.

3.2.4 Testing

Contract specification sections usually delineate a number of tests that may be required through field sampling or in-place testing. In complying with the CQC plan requirements, the contractor must provide a testing plan which identifies items to be tested, the tests to be performed and their standards, as well as the specification sections which require the tests. As provided for by the CQC plan, the contractor must engage an independent commercial testing laboratory to perform all sampling and testing services required. The testing laboratory employed by the contractor must be accepted by the government prior to the commencement of any testing. Acceptance of the testing laboratory is subject to strict criteria. The contractor is required to provide:

- a) Name, registration number, and engineering discipline of the Registered Professional Engineer in charge of the laboratory

- b) Affidavit of compliance with ASTM E 329 and ASTM D 3740 and certification that the laboratory performs work in accordance with requirements as stated in the contract specifications
- c) A list of testing equipment proposed for each test procedure including latest calibration data
- d) A copy of the latest laboratory inspection report by an independent agency with laboratory certification that deficiencies (if any) have been corrected
- e) Names and qualifications of persons actually performing testing and sampling. Changes in personnel must be approved by the Contracting Officer prior to performance of any work under the contract
- f) Evidence of a license to operate as a commercial testing laboratory (if the state requires licensing)

[NAVFAC Guide Specification Section 01400,
Contractor Quality Control (CQC) System]

Factory testing is usually performed by the manufacturer with a certified copy of test results indicating compliance with the specifications being submitted by the contractor as a Manufacturer's Certificate of Conformance or Compliance. In the event testing is required by an outside testing laboratory, different from the one he used for field testing, it must also pass through the acceptance process prior to use on the project.

3.2.5 Documentation

The contractor is required to report daily on the progress of work under the contract. Known as the CQC Daily Report (Fig. 2), this document is a detailed report identifying prime and subcontractor personnel and equipment on site, idle equipment and personnel, material deliveries, weather conditions, work accomplished, inspections and tests conducted, results of inspections and tests, nature of defects found, causes for rejection, proposed remedial action, and corrective actions taken. The report includes a certification, signed by the CQC Representative, that all materials and equipment used and work performed during the period of the report are in compliance with the contract plans and specifications.

Any test results submitted must cite the contract requirements, the test or analytical procedures used, the actual results, and include a statement that the item tested or analyzed conforms or fails to conform to the specification requirements. The test reports are required to be signed by a representative of the testing laboratory authorized to sign certified test reports. As results are received they are to be forwarded promptly to the Contracting Officer. The results are also recorded on the testing plan (Fig. 3).

CONTRACTOR'S QUALITY CONTROL DAILY REPORT (EXAMPLE FORMAT)

*Complete report in detail daily. If more space is needed, attach additional sheets.
CQC REP is data and initial additional sheets. Attach test reports, delivery slips and
instruments.*

| | | | | |
|---------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------------------|
| | | | | DATE |
| CONTRACT NO. | | TITLE AND LOCATION | | REPORT NO. |
| CONTRACTOR (Prime or Subcontractor) | | | NAME OF SUPERINTENDENT OR FOREMAN | |
| WEATHER - A.M. | | | TEMPERATURE - A.M. °F | |
| WEATHER - P.M. | | | TEMPERATURE - P.M. °F | |
| PRIME CONTRACTOR/SUBCONTRACTOR WORKFORCE <small>(If space provided below is inadequate, use additional sheets)</small> | | | | LOCATION AND DESCRIPTION OF WORK PERFORMED |
| NUMBER | TRADE | HOURS | EMPLOYER | |
| | | | | |
| | | | | |
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| | | | | |
| TOTAL WORK HOURS ON JOB SITE THIS DATE | | WERE THERE ANY LOST TIME ACCIDENTS THIS DATE? <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", A COPY OF THE COMPLETED OSHA REPORT IS REQUIRED | | |
| CUMULATIVE TOTAL OF WORK HOURS FROM PREVIOUS REPORT | | | | |
| TOTAL WORK HOURS FROM START OF CONSTRUCTION | | | | |
| INSPECTION AND/OR TESTING PERFORMED TODAY - FOLLOW WITH REPORT | | LOCATION AND/OR ELEMENT OF WORK | | REMARKS RESULTS OF INSPECTIONS/TESTING |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Sheet of .

Fig. 2 - Contractor's Quality Control Daily Report
(front)

(reproduced from NAVFAC Guide Specification Section
01400, Contractor Quality Control (CQC) System)

TESTING PLAN

[illegible]

Fig. 3 - Testing Plan (sample form)

(reproduced from NAVFAC Guide Specification Section 01400, Contractor Quality Control (CQC) System)

Submittals, as identified and required by the contract, are required to be submitted for approval or for record purposes. Proper documentation not only includes the submittal itself with cover sheet certifying compliance with the contract specification but also the CQC Submittal Status log (Fig. 4). The contract requires that all submittals be provided to the Contracting Officer no later than the expiration of 50% of the contract's time period for performance.

A Non-Compliance Check-Off List (Fig. 5), is required to document work that does not conform to nor comply with the contract documents and action taken to correct the deficiency. This report is submitted on a monthly basis to the Contracting Officer.

The CQC Representative, in addition to conducting the weekly CQC meeting, is required to provide copies of the minutes to the Contracting Officer. While providing a running record of the discussions held, it also provides an opportunity to review and ensure that all concerned agree with what occurred at the meeting.

As-built drawings must be kept on the job site to document the work as it proceeds. It is the responsibility of the CQC Representative or a Specialized Supplemental person assigned to maintain the as-built drawings. They shall show any deviations which have been made from the contract drawings,

NON-COMPLIANCE CHECK-OFF LIST

Contract No. and Title: _____

Contractor: _____

| DATE NON-COMPLIANCE IDENTIFIED | ITEM | CONTRACT REQUIREMENT (Spec. Section and Para. No., Draw. No. and Detail No., etc.) | ACTION TAKEN BY CQC REP. | RESOLUTION | DATE RESOLVED |
|--------------------------------|------|---------------------------------------------------------------------------------------------|-----------------------------|------------|------------------|
| | | | | | |

Fig. 5 - Non-Compliance Check-Off List (sample form)
(reproduced from NAVFAC Guide Specification Section
01400, Contractor Quality Control (CQC) System)

including buried or concealed construction and utilities which are revealed during the course of construction and shall be maintained on a daily basis. Upon completion of construction, the CQC Representative is required to certify the accuracy of the as-built drawings and submit them to the Contracting Officer for record.

3.3 The Government's Role

The government's agent, in this case the Navy's Contracting Officer, is responsible for enforcement of the contractor's CQC program. The Resident Officer in Charge of Construction (ROICC), the local government construction contract administrator, is involved from the design of the project through to its completion. He participates in the determination of whether a contract will utilize CQC or not, assuming the contract does not meet the standard guidelines. The ROICC will assist in the design by advising the A/E firm of which areas of construction require increased emphasis or inspection due to their technical nature or complexity.

Once beyond the design stage, the ROICC becomes a key participant in the contractor's quality control operations. His involvement with the program establishes itself with the review and approval of the contractor's CQC plan. With the exception of mobilization work which includes surveying for the

location of contractor's offices, laydown areas and temporary utilities, plus demolition work and installation of temporary utilities, no construction work is allowed at the site prior to the ROICC's approval of the CQC plan.

Problems encountered in the approval range from minor changes to major revisions. In the instance of minor changes, the ROICC may approve the CQC plan contingent upon correcting of deficiencies by a specified date agreed to in writing by the contractor. If the plan has major problems, the ROICC will usually offer to meet with the contractor to clarify requirements, recommend solutions, and encourage rapid correction of the plan by the contractor. However, the ROICC must not allow the contractor to start work until the plan is acceptable.

In order to expedite the work under the contract the ROICC may allow the contractor to submit a preliminary CQC plan. Submitted within 15 calendar days of the Notice of Award, this plan includes all items required under the normal CQC plan for the first 90 calendar days of work after receipt of the Notice of Award. Generally, this covers work which is deemed to be routine and non-complex in nature by the ROICC. No other work will be allowed to commence until the entire CQC plan is approved. Action of this nature requires

the ROICC to have a great deal of confidence in the contractor and thus is exercised sparingly.

After the CQC plan is reviewed and approved, the ROICC must monitor its implementation to assure that the contractor's CQC organization is functioning as planned. The individual most involved is the Navy inspector, or Construction Representative. He is in daily contact with the project, performing a quality assurance function. Traditional tasks include:

- a) Assisting the contractor in obtaining gate passes and clearances
- b) Assisting in arranging for use of government utilities and transfer of government furnished equipment
- c) Coordinating construction with the activities involved, make or arrange for inspections or tests specified to be performed by the government
- d) Acting as the contractor's normal contact with the ROICC office

[LANTNAVFACINST 4355.1C, encl. (1)].

Duties unique to a CQC project include:

- a) Being familiar with the CQC plan
- b) Reviewing the daily CQC reports and taking whatever action is necessary to ensure complete and correct reports
- c) Making site visits to determine the adequacy of the CQC Representative's performance such as:
 - 1) Checking certifications of material and equipment delivered to the site
 - 2) Spot-checking workmanship

3) Observing test procedures

4) Reviewing the CQC Representative's
submittal log, deficiency list,
testing log, etc.

- d) Preparing final inspection punch lists to
supplement the list prepared by the CQC
Representative

[LANTNAVFACINST 4355.1C, encl. (1)].

Initially, he should spend as much time on the CQC project as he would on a non-CQC project. Assuming increased confidence in the CQC organization based on acceptable performance, he may decrease his time on the CQC project and devote it more productively on other projects. The converse, however, may be true requiring additional time and some form of corrective action.

The Construction Representative must take care in the performance of his duties as a quality assurance representative for the Navy. He must let the CQC Representative perform his duties, including the opportunity to report on deficiencies and note corrective action taken or to be taken. This may entail that upon observing a deficiency the Construction Representative wait a period of time, no more than a day, before advising the CQC Representative of the problem. He must not instruct the contractor on how to accomplish the work. As such, the Construction Representative should restrict his deficiency notices

to defects in the work, inadequacies in the CQC Representative's performance, and errors and omissions in the daily CQC report.

CHAPTER 4

PROGRAM MAINTENANCE

The contractor and the government are both interested in quality construction simply because it means to the government - getting our money's worth, and to the contractor - satisfactory performance and profits. From the opening of the preconstruction meeting through to the final inspection the emphasis should be on a cooperative effort to make the CQC plan work. The government's interest is in maintaining the necessary control to prevent deficiencies and tear outs and it will therefore emphasize inadequacies in the control system instead of individual construction deficiencies. Also, by noting inadequacies in the contractor's CQC system as well as by assuring that defective work is corrected, the government maintains a true double check on quality. However, the system is not infallible.

4.1 Problems

Problems encountered during construction vary according to the specific project. Most problems, however, fit into one or more of the following categories:

- a) Delays. Delays may occur in submittals, the correction of deficiencies, or due to lack of acceptance of the CQC plan.

- b) Planning and control. Many problems are caused by a lack of planning and control and failure to take corrective action during this process.
- c) Testing. Problems arise due to improper, inadequate, or untimely testing.
- d) Documentation. Late, incomplete, or incorrect documentation can create problems. The written record of quality control action and test results is as important as the actions themselves. The CQC reporting system may cause appropriate corrective action to be taken, or may be the basis of settlement of expensive claims at a future date, after people directly involved are no longer available. If documentation is inadequate, communications between the contractor and government break down, and the legal positions of both are jeopardized.
- e) Contractor apathy. Unfortunately, not all contractors endorse the CQC program. Problems with lack of support at the higher levels of management are difficult to solve and can be extremely frustrating

[Contractor Quality Control Seminar booklet, October 1986, Western Division NAVFAC].

4.2 Corrective Actions

The Navy can take action in a variety of ways to correct these and other problems. The initial course of action is informal and involves the Construction Representative discussing the problem with the contractor's site superintendent and CQC Representative. These discussions revolve around the corrective action to be taken and the ultimate consequences of poor contractor quality control. He may also point out the advantages of improved quality control with the emphasis on saving money and work time

if problems are discovered by the CQC Representative and corrected immediately, before any other work is performed and the problem becomes more difficult to correct.

Failure of informal discussions at the field level result in an elevation of the problem to the next level of each organization. The ROICC, at this time, should advise the contractor that continued poor performance will result in an interim unsatisfactory performance appraisal. Whatever method is used by the ROICC at his level, it should be prompt and direct in order to identify the problem early so it may be prevented, or corrective action can be taken.

Efforts at the field level do not always yield desired results. This usually leaves no choice but to initiate action under the General Paragraphs of the contract that provide the means for enforcing contract compliance. This action should be taken without hesitation, and not in a half-hearted fashion which may give an impression of weakness or indecisiveness.

There are numerous options available to the Navy under the General Paragraphs of the contract, the first of which is requiring the contractor to remove and replace deficient materials and workmanship. The issuance of a Construction Compliance Notice is used to accomplish this action. If the contractor is allowed

to get by with significant deficiencies, the effectiveness of, and incentive to comply with, CQC are reduced. This option allows the government to require the contractor to expose, test, and remove or replace unacceptable work. If necessary, the Navy may employ other resources to correct the deficiency and charge the contractor if he refuses to correct it himself. When taking any action of this sort the contractor's Surety is notified. The Surety has a vested interest as they have provided the contractor's bonds and will usually require the contractor to perform. This action has a potential backlash. If the contractor has been found to have performed the work correctly the first time, any additional costs incurred through exposing, testing, and removal and replacement will be borne by the government. As a result, this option is exercised very sparingly.

The government may withhold payment for a variety of reasons. This can include the contractor's failure to; perform in accordance with the contract, provide the CQC plan giving assurance of his intent and ability to comply with the standards set forth in the contract documents, build to quality standards, or document his performance. As most contractors are operating on borrowed funds, withholding of payment may impact on the contractor's operating capital and affect his

ability to pay subcontractors or his own personnel, or make payments on any borrowed money.

If contractor personnel are found to be incompetent, careless, or otherwise unsuitable, the Contracting Officer can require the removal of such personnel from the job. Action of this nature must be supported by facts which show continued activity to warrant such a decision. If individuals in the CQC organization are found to be incompetent, immediate corrective action is required of the contractor. Lack of action can result in the government directing removal of the individual concerned and a replacement provided that meets the requirements of the contract and is acceptable to the government.

The contractor may be required to provide personal supervision if his designated superintendent performs unsatisfactorily. This action could backfire as the contractor may be less competent than the individual originally assigned as superintendent, thus creating a worse situation. If the situation deteriorates after this action, few alternatives remain other than termination.

The performance of unsatisfactory work can be halted by the government. This may occur prior to the start of construction by refusing to permit work until approval of the CQC plan. Work may also be stopped if

deficient work is not corrected. This is of special concern as the deficient work may be built upon, enclosed, or become inaccessible due to additional construction. Prompt action by the ROICC is important in order to prevent a compounding of the problem. A letter to the contractor directing him to cease work citing the deficiency and not to proceed until the work is corrected may be warranted. Strict adherence to the ROICC's position will prevent the contractor from "stonewalling" and possibly forcing the government to accept substandard work. Acceptance of substandard work for the sake of schedule must not be permitted.

Unsatisfactory performance appraisals may be effective in improving quality control on a project. Performance appraisals are issued upon completion of a project and are used in future evaluations of contractors for contract award. Interim performance appraisals, as well as letters to the contractor stating that continued substandard performance will result in an overall unsatisfactory performance appraisal, will afford the contractor the opportunity to correct his deficient operations. Most contractors are proud of their work and their reputations, and know the importance of unsatisfactory appraisals. Performance appraisals should also reflect outstanding work by a contractor if warranted. Proper recognition

ensures a positive attitude in the contractor and motivation for continued good work.

The most drastic action that can be taken is termination of the contract. Recommendation of this action must be carefully considered. The impact on the contractor can be far-reaching and if unjustified, can cost the government money in claims. Therefore, strong and accurate documentation is a must to support this type of action. In any case, unsatisfactory performance must not be allowed to continue. In fact, the longer the unsatisfactory performance is allowed to continue, the more difficult it is to support termination action.

CHAPTER 5

FIELD OPERATION ASSESSMENT

The previous chapters have focused on CQC, its requirements and its proposed operation. This chapter will look at specific problems associated with implementation of the standard policy by various commands.

The Naval Facilities Engineering Command has placed increased emphasis on their quality control efforts. With this occurrence, the six Engineering Field Divisions (EFD) have created Quality Assurance branches to assist field offices in their quality control and quality assurance efforts. Guidance provided to field offices will invariably differ at each EFD giving rise to questions on the CQC program's implementation and effectiveness. A questionnaire (Fig. 6), was therefore prepared and sent to each EFD and to two major Officer in Charge of Construction (OICC) offices in an effort to assess the program's operation in the field. A 100% response was received to the questionnaire. Telephone interviews were also conducted as a preliminary to the questionnaire. From the results, several interesting trends can be seen.

CQC Program Questionnaire

1. Does your command have a Quality Assurance Plan? If so, does it contain specific guidance on CQC?

2.a) Do problems exist in implementing CQC at the field level? If so, what kind of problems are encountered?

b) What benefits do you feel we gain from CQC?

c) Please comment on the effectiveness of the CQC program.

3. Does your EFD have a training program set up to instruct field personnel on how to implement CQC?

4. Do you use Title II inspection in conjunction with CQC? If so, what guidelines do you use?

5. Does your EFD get involved with the ROICC at the onset of each contract to ensure the CQC program starts up properly? If so, what actions are taken?

6. Has your EFD developed or incorporated any unique development or application into the CQC program?

7. Can you recommend any improvements to the CQC system?

Fig. 6 - CQC Program Questionnaire, p. 2

8. Please give an example of where CQC has worked properly.
(Contract number, location, or other specifics not required)

9. Please give an example of where CQC has not worked properly.
(Contract number, location, or other specifics not required)

10. Please provide any other comments or observations on CQC and its development, use, and/or future you may have.

11. Could you please provide copies of the following documents and any others you may feel appropriate:

Sample CQC or Contractor Inspection (CI) specification section
EFD Instruction on CQC

Please return this survey and any other requested information to:

LT Robert L. Jordan
Dept. of Naval Science
University of Florida
Gainesville, FL 32611

Thanks again for your help

5.1 Quality Assurance Plan

The existence of a Quality Assurance Plan giving specific guidance on CQC was not evident at all of the offices that responded. As a rule, plans are developed for individual projects based on their complexity to highlight areas of special concern or that are critical to the job. One respondent stated that they have the A/E firm prepare a plan concurrent with completion of a design.

Other offices have developed Quality Assurance Improvement Plans which cover improvements in planning, design, and construction. These documents give specific recommendations and actions pertaining to CQC for the commands. They focus on problem areas in the program as a whole and address each item requiring increased emphasis and support.

5.2 Implementation

There is consensus among those replying that problems exist in implementing CQC at the field level. Problems encountered include:

- a) Lack of enforcement
- b) Negative attitude toward CQC
- c) Frequent turnover of personnel

Uniform enforcement of CQC provisions is considered paramount by those responding. It is felt that only a good CQC plan uniformly enforced across the

board, along with a good Construction Representative will make CQC work. Several stated that relaxation of provisions tended to lead to a decrease in effort on the part of the contractor, the end result being a quality of work less than required by the contract.

The attitude towards CQC as a program was indicated to be fairly negative at the field level. The primary complaint being raised was that CQC was similar to having the "fox guard the henhouse." This is an allusion to the fact that the CQC Representative is hired and paid by the contractor. It is felt that the CQC Representative will not fully enforce the quality provisions of the contract, resulting in government personnel performing the quality control role which the contractor is being paid to do.

Some respondents claimed that frequent turnover in contract administration personnel plays a contributing role in CQC's implementation problems. Departure of personnel results in a departure of corporate knowledge on a particular contract with the concurrent problem of the replacement not being aware of policy, procedures, etc. Lack of replacement personnel, it is stated, contributes to an existing manpower shortage in the field, making it difficult to properly administer CQC projects.

5.3 Benefits

When queried about the benefits to be realized from the use of CQC, the response was unanimous that the program placed the liability for quality control on the contractor. Responses keyed on two high visibility issues in the contract administration area: rework and claims for delay. It was felt that properly applied CQC will force the contractor to be responsive to the requirement to correct deficient work, resulting in work performed correctly the first time and thereby requiring less rework. Claims for delays due to submittal review are minimized as this action is the contractor's responsibility under CQC. Another prominent feature was that a lower level of government staffing is required for inspection and surveillance. The lower demand on government resources allows better inspection on non-CQC contracts under the government's purview.

5.4 Effectiveness

Response as to the effectiveness of the program indicated only marginal results have been obtained. Reasons vary from the problems of implementation listed above, to training of field personnel and lack of enforcement provisions in the contract specifications. Effectiveness was said to vary even from field office to field office. Most EFD's felt the establishment of the Quality Assurance branch, along with the

development of more stringent CQC specification requirements, were a step toward increased CQC effectiveness.

One respondent stated that CQC has not relieved the Navy of the need to inspect contractor work in detail. It was felt that CQC, however, does give the government a tool with which to enforce contractor compliance with quality provisions.

5.5 Training

Formalized training in the operation of CQC is in existence at half of the EFD's that responded. One EFD provides a booklet with guidance during training seminars that it conducts. Another, while not having a formal training plan, does make presentations during ROICC conferences accompanied by hand-out materials. In one instance, training is left to the discretion of the individual OICCs. In all respondents it appeared that training was being provided in some form, however, the format and level of intensity varied.

5.6 Title II Inspection

The Title II inspector is contracted under the A/E services to supplement the inspector work force at a ROICC office. The Title II inspector does not replace the government inspector but performs nearly identical functions. When asked if the services were used in conjunction with CQC, the response was in the

affirmative and qualified. Title II inspection use was generally limited to a particular expertise requirement desired on a project or where necessary to supplement limited resources in particular locations. No specific guidelines existed with respect to the use of Title II in conjunction with CQC.

5.7 Involvement at Start-up

During telephone conversations with the different EFD's a concern was raised that the CQC program on a given project start properly. As a result, the question was posed to the EFD's on their involvement with the ROICC at the onset of a project to ensure that the CQC program would operate successfully. The degree of involvement varied. One EFD conducts a training seminar with each contract administration team prior to the preconstruction conference. Another goes a step further by attempting to attend the preconstruction conference and the first CQC meeting. Review of the CQC plan by the ROICC in some cases is supplemented by a concurrent review of the plan by the EFD. The level of coverage varies from sampling to all plans. In each case the EFD provides advice to the ROICC pertaining to compliance.

Where no current involvement was indicated, one EFD was considering providing the assistance mentioned above and another left this action to the local OICC due to physical separation.

5.8 Unique Developments

No unique developments or application of the CQC program beyond the increased level of qualifications of the CQC Representative is provided for in the specification section for EFDs exercising control in U.S. territory. In EFDs exercising control outside U.S. territory, certain members of the CQC staff are required to be U.S. registered engineers. In some cases, A/E firms that may be performing submittal review and approval are required to be U.S. firms.

5.9 Recommended Improvements

Recommendations for improvements to the CQC system were requested. One EFD suggested increased emphasis within the NAVFAC organization. The primary concern was that the EFD Commander or Commanding Officer must make CQC a high interest item and convey that interest down the chain of command to the ROICC offices. Another suggested that CQC be accomplished by individuals outside of the construction effort and possibly carry out its provisions at the subcontractor level. Others suggested a "wait and see" approach with regard to the increased CQC Representative qualifications requirement before making any recommendations for improvement.

CHAPTER 6

PROGRAM ANALYSIS AND RECOMMENDATIONS

The Navy's Contractor Quality Control program is a system that appears to have been only marginally effective since its inception. Problems experienced on both the contractor's and government's sides of the program have caused an increase in concern by upper level Navy management. A series of actions have been taken to correct these deficiencies. The current CQC program, working properly, should provide the desired level of quality construction desired. In this chapter the various problems and corrective actions being taken as well as associated program benefits will be discussed.

6.1 CQC Organization

In past projects involving CQC only a single CQC Representative has existed on the contractor's quality control staff. On highly complex projects this would pose a problem as oftentimes particular facets of the job would be outside the CQC Representative's area of expertise. While the specification section provided the opportunity for expansion of the CQC staff to supplement the CQC Representative, such action was rarely taken. Measures taken to correct this deficiency require an in-depth review by the A/E and the ROICC during the design to determine any

requirements for supplemental personnel on the CQC staff and the experience level that each person must possess.

Another problem experienced has been the level of expertise possessed and displayed by the CQC Representative himself. On occasion, this individual may have had the experience required for the assignment, but not necessarily the skill to fulfill the duties required. The contract specification section has been changed to provide for a more qualified individual in the position of CQC Representative. These increased requirements, which include professional registration as an engineer or architect, have been successfully used at OICC Trident. A positive by-product of this requirement is that the registered individual not only must comply with the contract specifications, but must also adhere to his professional code of ethics.

The drive to increase both the staffing of the CQC organization and the qualification of its members is a move in the positive direction. It will provide an increased level of expertise in the contractor's organization which should pay dividends to both sides. It will better allow the contractor to detect problems before they occur rather than after, thus reducing unwanted rework.

6.2 Attitudes

One of the largest stumbling blocks to effective CQC is the attitude held by the parties involved. A number of factors must be considered when assessing this problem.

6.2.1 The Contractor

The contractor's prime motivation on a construction project is to perform the work for the lowest cost possible in order to obtain the largest profit margin. Employing additional "non-productive" individuals beyond a site superintendent is obviously not viewed favorably when additional salaries must be considered. Lack of enforcement on previous contracts contributes to an indifferent attitude towards CQC requirements in a contract specification. Keeping in mind that government contracts are traditionally awarded to the lowest bidder, it is not surprising that many contractors only pay "lip service" to CQC. Changing this attitude will require much effort. Contractors need to be made aware of the savings that can be made through the utilization of CQC beyond the cost of additional personnel, such as the costs associated with rework. The Navy must also let contractors know that the requirements of CQC will be enforced completely. This will allow contractor to bid appropriately and not attempt to "low ball" a bid.

These efforts should help gain much needed support of CQC by upper level management in contracting firms.

6.2.2 The Government

The attitude expressed by a number of individuals tasked to administer CQC is that it is nice in concept, but it will never work. This is attributable to a perceived conflict of interest on the part of the CQC Representative and the belief that the government inspector will ultimately have to perform the CQC Representative's job. Most consider CQC as the "fox guarding the henhouse" since payment of the CQC Representative comes from the contractor on whom he is supposed to enforce quality control. Some past CQC Representatives have allowed contractors to provide quality less than required by the contract hoping to avoid on the job conflict and potential delay in payment. This has required additional effort by Navy inspectors to ensure quality control is performed. Efforts to educate government representatives of past and potential success with CQC through strong enforcement action, and that upper level management support is present, can help change this opinion. Top level management must support the CQC program or it will not work.

6.3 Enforcement

The key to making CQC work is strict enforcement of the contract provisions. Adequate tools exist to provide proper enforcement of the CQC provisions. However, too often the government representative allows what he considers a minor item to go unaccomplished. This can be, and usually is, read by the contractor to mean that CQC is not that important. The result can be total failure of the program. Efforts to correct such a faux pas can be costly. Qualified personnel are important to ensuring the program works. NAVFAC is attempting to provide these qualified people through training and lengthening tours of duty for military personnel in the ROICC offices. In addition, the program cannot be allowed to run on auto pilot. Adequate, timely surveillance can prevent many of the problems experienced with CQC.

6.4 Training and Assistance

The establishment of the Quality Assurance branches at each EFD has provided a single point for field offices to gain much needed help in making CQC work. These offices can provide review of CQC requirements on a given project, concurrent review of CQC plans submitted by contractors, assistance in system start-up at the preconstruction conference, and assistance in program maintenance during construction

if needed by the field office. This can provide a peace of mind to the field office that it is not on its own with respect to implementing CQC, especially if the office is staffed with inexperienced people.

In order to overcome the lack of experience, the efforts of some branches in setting up training plans is exemplary. Most ROICC offices need some degree of training so their people will be able to properly implement CQC. The added confidence an individual receives from training cannot be overlooked. Branches that have not done so, should seriously consider implementing training programs directed at their field offices if they expect to see any improvement in the effectiveness of CQC.

6.5 Benefits

While it may seem that the CQC program is ineffective, there are benefits to be gained by its use. Primarily, the contractor is responsible for the quality of work that he produces. He essentially has control over all the effort going into providing a finished product. If the contractor conscientiously applies CQC to his project he can not only reduce costs associated with repairs to, or replacement, of defective work, he can also improve his performance with respect to any schedule he may have set for himself outside the provisions of the contract. The

contractor's reputation as a quality contractor will be enhanced and his actual profit may increase.

Benefits to be gained by the Navy can be realized through a reduction in time required in surveillance of the contractor's activities. This can result in more effective use of government inspection on other projects as well as extending limited resources over several projects. Additional cost savings to the government can be realized through a decrease in contractor claims for submittal review delay and inspection delays.

6.6 Recommendations

Improvement of the CQC program is reliant on several factors. A change in attitude must take place, not only by the contractor, but also by the government. Everybody involved with CQC must be made to understand that it can work if properly applied. This requires strict conformance by the contractor and stringent enforcement by the government.

The means to this goal is education and training. The current move to providing training to field personnel should be followed up with the development of refresher courses. It might be beneficial to provide a presentation periodically to local contractors on the CQC program. This would pay dividends as contractors would not only receive

instruction in the program's operation but also on the philosophy behind the program.

A possible alternative to the current method of having the CQC Representative hired by the contractor is to have him hired in a fashion similar to the Title II inspection program. By having the A/E who performed the design provide the CQC effort, the potential for conflict of interest could be substantially reduced. Not only would the CQC staff be intimately familiar with the project concept, there would be no fiduciary ties to the contractor and the associated potential for negative pressure from the contractor.

Support of the CQC program in the field is essential to improvement in its implementation. The establishment of Quality Assurance branches provides the organization for this support. Their involvement in each project should include the determination of whether CQC is to be used or not, provide refresher training to the contract administration team prior to contract award, attend the preconstruction meeting to help ensure the contractor understands what is required by CQC, and attend the first CQC meeting to assist the ROICC and assess how the program is starting. The Quality Assurance branch should conduct periodic visits to assess the effectiveness of the program as well as provide necessary guidance to correct any deficiencies they may find.

CHAPTER 7

CONCLUSION

In today's environment of spiraling costs and deadline pressures it is easy to forget that quality is a must in every construction project. The Navy with its Contractor Quality Control Program is attempting to ensure that it receives the quality product it is paying for. By placing the emphasis of quality control on the contractor, the benefits of timely completion and cost effective construction projects should result.

From the results of the survey and subsequent research, the following conclusions may be drawn.

The philosophy behind CQC is appropriate and if executed properly will yield the desired results of quality construction. However, the program is fraught with opportunity for failure. It is important to realize that as the system is currently programmed, it relies on the integrity of each party to carry out all the requirements as stipulated in the contract. Each party must be convinced the system will work and strive to make it work. If the contractor has decided to give only a half-hearted effort in performing quality control, either by providing a less than qualified CQC staff or poor construction practice, the government will expend as much time and effort administering the CQC project as it would a non-CQC project. While

enforcement provisions exist, they are reluctantly enforced due to fear of contractor reprisal, usually in the form of a claim. The claim itself may be unsubstantiated, however, it will achieve the effect desired by the contractor which is to force the government to expend additional time and effort on the project.

The specification sections can be a weak link in the quality control process. It is important to ensure that the experience level of the CQC Representative and any supplemental personnel be adequate for the project. The technical sections must provide the level of quality desired.

The CQC program has improved through the development of more specific specification requirements and high level organizational support. Its marginal success, notwithstanding OICC Trident, is indicative of the support it receives in the construction industry. Until the contractor who performs government work, as well as the Navy representative administering it, understand and actively support CQC, it will continue to have only marginal success. As such, it probably will not achieve the benefits of higher quality construction and better utilization of government inspectors.

The CQC program, even with the problems that exist, has the potential to produce good results. Only with complete support from all involved will CQC provide the desired result, quality construction.

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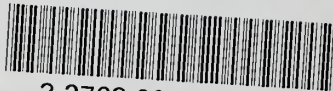
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